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# INDUSTRIAL AUTOMATION



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## TRAINER GUIDE

National Vocational Certificate Level 2

Version 1 - September, 2019



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## **Introduction**

Competence-based training helps to bridge the gap between what is taught in training and what tasks will be performed on the job. Training trainees to perform actual job functions helps to ensure that future front-line workers have the skills, knowledge and abilities required to perform their jobs properly, safely and effectively. In addition to competence-based training, assessment based on the performance of actual work competencies helps to ensure that:

- trainees are performing their work tasks as safely as possible
- performance gaps are recognized prior to serious incidents
- training can be implemented to improve competence.

There are significant benefits to competence-based training:

### **1. Cost effectiveness**

Since training activities and assessments in a competence-based approach are goal-oriented, trainers focus on clearly defined areas of skills, knowledge and understanding that their own industry has defined in the competence standards. At the same time, trainees are more motivated to learn when they realize the benefits of improved performance.

### **2. Efficiency**

The transfer gap between the training environment and working on the job is reduced substantially in a competence-based approach. This is because training and assessment are relevant to what needs to be done on the job. As a result, it takes less time for trainees to become competent in the required areas. This, in turn, contributes to improved efficiency where training and assessment are concerned.

### **3. Increased productivity**

When trainees become competent in the competence standards that their own industry has defined, when they know what the performance expectations are and receive recognition for their abilities through successful assessments, they are likely to be more motivated and experience higher job satisfaction. The result is improved productivity for organizations. The communication and constructive feedback between future employers and employees will improve as a result of a competence-based approach, which can also increase productivity.

#### **4. Reduced risk**

Using a competence-based approach to training, development, and assessment, employers are able to create project teams of people with complementary skills. A trainee's record of the skills, knowledge and understanding relating to the competence standards they have achieved can be used by a future employer to identify and provide further relevant training and assessment for new skills areas. Competence standards can shape employee development and promotional paths within an organization and give employees the opportunity to learn more competencies beyond their roles. It can also provide organizations with greater ability to scale and flex as needed, thereby reducing the risk they face.

#### **5. Increased customer satisfaction**

Employees who have been trained and assessed using a competence-based approach are, by the definition of the relevant competence standards, able to perform the required tasks associated with a job. The knock-on effect is that, in service-related industries, they are able to provide high service levels, thereby increasing customer satisfaction. In production or manufacturing industries, they are able to work closely to industry standards in a more effective and efficient way.

#### **Lesson Plans:**

This manual provides a series of lesson plans that will guide delivery of each module for the Industrial Automation qualification. It is important for trainers to be flexible and be ready to adapt lesson plans to suit the context of the subject and the needs of their trainees.

Good teachers acknowledge that CBT means each and every trainee in the class learns at a different speed. The good teacher is prepared to throw aside the day's lesson plan and do something different (and unplanned) for the class even if it means 'writing' a lesson plan for each trainee to match their learning pace for that day or week.

Learning by doing is different from learning theory and then applying it. To learn to do something, trainees need someone looking over their shoulder saying 'it's not quite like that, it's like this', 'you do it like this because ...', or even 'tell me why you chose to do it like this?'.

In this way, trainees learn that theoretical knowledge is meaningless if it is not seen in the context of what they are doing. In other words, if a trainee doesn't know why they do something, they will not do it competently (skills underpinned by knowledge = competent performer).

This is how an Industrial Automation learner acquires a practical grasp of the standards expected. It's not by learning it in theory, but because those standards are acquired through correction by people who show what the standards are, and correct the trainee where they do not meet those standards, and where they repeat it correction until they have internalized those standards.

### **Demonstration of a Skill:**

Demonstration or modeling a skill is a powerful tool, which is used, in vocational training. The instructions for trainers for demonstration are as under:

- a) Read the procedure mentioned in the Trainer Guide for the relevant Learning Unit before demonstration.
- b) Arrange all tools, equipment and consumable material, which are required for demonstration of a skill.
- c) Practice the skill before demonstration to trainees, if possible.
- d) Introduce the skill to trainees clearly at the commencement of demonstration.
- e) Explain how the skill relates to the skill(s) already acquired and describe the expected results or show the objects to trainees.
- f) Carry out demonstration in a way that can be seen by all trainees.
- g) Use the same tools and materials that the learner will be using.
- h) Go through EACH of the steps involved in performing the skill.
- i) Go SLOWLY - describe each step as it is completed.
- j) Encourage the learners to move around and watch what you are doing from a number of different angles.
- k) Identify critical or complex steps, or steps that involve safety precautions to be followed.
- l) Explain theoretical knowledge where applicable and ask questions to trainees to test their understanding.
- m) Try to involve the learners: Ask them questions about why they think the process may work that way.
- n) Repeat critical steps in demonstration, if required.
- o) Summarize the demonstration by asking questions to trainees.

Involvement in the process (actively seeing) is important at this stage. When you work on getting involved, getting people to participate, you make them a part of what is happening. Questions for clarification or explanation are important throughout the demonstration. It is up to the learners to ask questions about things they do not understand, but it is also important for trainers to seek out and elicit questions from learners. A trainer may need to do repeated demonstrations of difficult or complex skills.

Remember that the learner will learn a lot from your demonstration - and not just the demonstration itself. Learners will learn about how to perform the skills, but they will also learn from watching demonstrations how trainers treat the tools or materials and how they follow safety procedures.

After the demonstration, it is important to again seek out questions - be sure all questions are answered. The trainer should ask the learner if they are ready to try the skill. If not, there may be a need for recycling the demonstration (or part of it), and clarifying some of the information.

## Overview of the program

<b>Course:</b> NVQ Certificate Level 2 in Industrial Automation	<b>Total Course Duration:</b> <b>Hours</b>
<b>Course Overview:</b>	
<p>The Industrial Automation program is to engage young people with a program of development that will provide them with the knowledge, skills and understanding to start their career in Pakistan as Industrial Controls &amp; Automation skilled person , technician or expert. The program has been developed to address specific issues, such as the national, regional and local cultures, the manpower availability within the country, and meeting and exceeding the needs and expectations of their customers.</p>	

<b>Module Title and Aim</b>	<b>Learning Units</b>	<b>Duration</b>
<p><b>Module 5:</b> Apply Electric Circuit Concepts</p> <p><b>Aim:</b> The aim of this module to get knowledge, skills and understanding to apply electric circuit concepts</p>	<p><b>LU1:</b> Perform measurement of electrical quantities using meters</p> <p><b>LU2:</b> Perform calculations of electrical quantities</p> <p><b>LU3:</b> Use electric diagrams and symbols</p> <p><b>LU4:</b> Install DC Circuits wiring</p> <p><b>LU5:</b> Install AC circuit wiring</p> <p><b>LU6:</b> Terminate cables and circuit accessories</p>	140
<p><b>Module 6:</b> Install Automation Instruments</p> <p><b>Aim:</b> The aim of this module to get knowledge, skills and understanding to install automation instruments</p>	<p><b>LU1:</b> Install Digital Instruments</p> <p><b>LU2:</b> Install Analogue Instruments</p> <p><b>LU3:</b> Install Hydraulic and Pneumatic Equipment</p>	110



# INDUSTRIAL AUTOMATION



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Module-5

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## Trainer's Guidelines

### Module 5: 071400935 Apply Electric Circuit Concepts

**Objective of the module:** The aim of this module to get knowledge, skills and understanding to apply electric circuit concepts

Learning Unit	Suggested Teaching/ Learning Activities	Delivery Context	Media
<p><b>LU1:</b> Perform measurement of electrical quantities using meters</p>	<p>Deliver an illustrated presentation which consist of following points :</p> <ul style="list-style-type: none"> <li>• Understanding of Basic concepts of electrical quantities such as voltage, current and their units.</li> <li>• Understanding of active and passive components including resistors, capacitors, inductors, diodes &amp; transistors.</li> <li>• Understanding of different electrical energy sources and their measurement principles while adhering to standard grounding and grounding practice.</li> <li>• Understanding of different modes of digital multi-meter (Clamp meter, DMM) along with their corresponding levels/grades.</li> </ul>	<p>Lab / Training workshop</p>	<ul style="list-style-type: none"> <li>• White Board</li> <li>• Multimedia</li> <li>• Videos on the Basic understanding of Current, Voltage, active components, passive components (resistors, capacitors, inductors, diodes &amp; transistors etc.)</li> </ul> <p><a href="https://www.allaboutcircuits.com/video-lectures/electrical-quantities-a/">https://www.allaboutcircuits.com/video-lectures/electrical-quantities-a/</a></p>

**Module 5: 071400935 Apply Electric Circuit Concepts****Objective of the module:** The aim of this module to get knowledge, skills and understanding to apply electric circuit concepts

Learning Unit	Suggested Teaching/ Learning Activities	Delivery Context	Media
Industrial Automation	<ul style="list-style-type: none"><li>Recording the measured quantities by connecting the components of multi-meter.</li><li>Measurement of current &amp; voltage for a single loop circuit.</li><li>Differentiating between working and faulty electrical components.</li></ul> <p><b>Learners</b> must be divided in groups (4-5) students and are directed to make requisition from the store for the active and passive components of different values and understand their basic knowledge.</p> <p><b>Learners</b> are advised to issue tools and test apparatus from the store through requisition and understand their working. They must be fully confident of measuring the values of the above components in standalone form in the form of circuit. They should make a record of the observations and reading measured.</p> <p><b>Learners</b> are introduced various energy sources and concepts be clarified through videos.</p> <p><b>Learners</b> must be ultimately able to demonstrate their knowledge and skills relating to above topics.</p> <p><b>Ensure</b> that learners have the opportunity to ask questions to support their understanding</p>	Page   7	<ul style="list-style-type: none"><li>Videos on the Understanding of different electrical energy sources and their measurement principles. <a href="https://www.youtube.com/watch?v=4oxEn2NHHqE">https://www.youtube.com/watch?v=4oxEn2NHHqE</a></li><li>Videos on the basic Understanding of different modes of digital multi meter (Clamp meter, DMM) <a href="https://www.electronic-notes.com/articles/test-methods/meters/dmm-digital-multimeter.php">https://www.electronic-notes.com/articles/test-methods/meters/dmm-digital-multimeter.php</a></li></ul>

**Module 5: 071400935 Apply Electric Circuit Concepts****Objective of the module:** The aim of this module to get knowledge, skills and understanding to apply electric circuit concepts

Learning Unit	Suggested Teaching/ Learning Activities	Delivery Context	Media
<b>LU2:</b> Perform calculations of electrical quantities	<p>Deliver an illustrated presentation which consist of following points :</p> <ul style="list-style-type: none"><li>• Calculate current, voltage, resistance and power of a circuit as per requirement</li><li>• Solve series &amp; parallel circuits as per requirement</li><li>• Study the Basics of Ohm's Law.</li><li>• Operational knowledge of power and energy calculations for AC/DC Basic circuits.</li></ul> <p><b>Learners</b> must be divided in groups (4-5) students and should bread board simple circuits using resistors and make calculations for the current, voltage and resistance and tabulate the values. These values are used to verify the Ohm's Law.</p> <p><b>Learners</b> must practice a little bit complex series and parallel circuits and record the readings and then verify through the calculations.</p> <p><b>Learners</b> are advised to use these values to find the power and energy calculations for the same circuits.</p> <p><b>Ensure</b> that learners must be encouraged to ask questions to support their understanding for above topics.</p>	Classroom / Lab	<ul style="list-style-type: none"><li>• White Board</li><li>• Multimedia</li><li>• Videos for understanding of series and parallel Circuits &amp; Ohm's Law.</li></ul> <p><a href="https://www.youtube.com/watch?v=JKI8OxGLIjQ">https://www.youtube.com/watch?v=JKI8OxGLIjQ</a></p> <p><a href="https://www.youtube.com/watch?v=Cztil0re5Eo">https://www.youtube.com/watch?v=Cztil0re5Eo</a></p>

**Module 5: 071400935 Apply Electric Circuit Concepts****Objective of the module:** The aim of this module to get knowledge, skills and understanding to apply electric circuit concepts

Learning Unit	Suggested Teaching/ Learning Activities	Delivery Context	Media
<b>LU3:</b> Use electric diagrams and symbols	<p>Deliver an illustrated presentation which consist of following points</p> <ul style="list-style-type: none"><li>• Identify electrical and control symbols for components as per requirement</li><li>• Draw electrical single line diagrams manually as per requirement.</li><li>• Study standard symbols for electrical and control components and practice manual or computer-based drawing.</li><li>• Reading and understanding given standard drawing for power and control circuits.</li><li>• Draw single line diagrams for power and control circuits while understanding the basic working knowledge.</li></ul> <p><b>Learners</b> must be introduced various electrical and control symbols and are advised to draw manually as a standalone on drawing sheets and must understand and memorize them.</p> <p><b>Learners</b> must practice must practice these symbols to draw the single line diagrams as per the instruction of the trainer.</p> <p><b>Ensure</b> that learners must be encouraged to ask questions to support their understanding for above topics.</p> <p><b>Learners</b> must be ultimately able to demonstrate their knowledge and skills relating to above topics.</p>	Classroom / Lab	<ul style="list-style-type: none"><li>• White Board</li><li>• Multimedia /Internet</li><li>• Videos for understanding of various Electrical and Control Symbols.</li></ul>

Learning Unit	Suggested Teaching/ Learning Activities	Delivery Context	Media
<p><b>LU4:</b> Terminate cables and circuit accessories</p>	<p>Deliver an illustrated presentation which consist of following points :</p> <ul style="list-style-type: none"> <li>• Select tools and accessories as per requirement</li> <li>• Lay down cables as per requirement</li> <li>• Differentiate between cable and wire.</li> <li>• Different type of AC cables for single phase and three phase (with details of color coding, core specifications, wire gauges, and material, shielding and insulation specification).</li> <li>• Different type of DC cables (with details of rating, wire sizing and material, shielding and insulation specifications).</li> <li>• Knowledge of cable-selection tables as per international standards.</li> </ul> <p><b>Learners</b> must be introduced various electrical and control symbols and are advised to draw manually as a standalone on drawing sheets and must understand and memorize them.</p> <p><b>Learners</b> must practice these symbols to draw the single line diagrams as per the instruction of the trainer.</p> <p><b>Ensure</b> that learners must be encouraged to ask questions to support their understanding for above topics.</p>	<p>Electrical Lab</p>	<ul style="list-style-type: none"> <li>• White Board</li> <li>• Multimedia /Internet</li> <li>• Videos for understanding of Electrical and Control cables</li> </ul> <p><a href="https://www.youtube.com/watch?v=gtAaZ2hFYTA">https://www.youtube.com/watch?v=gtAaZ2hFYTA</a></p> <p><a href="https://www.youtube.com/watch?v=MOq-dKLnTfA">https://www.youtube.com/watch?v=MOq-dKLnTfA</a></p>

**Module 5: 071400935 Apply Electric Circuit Concepts****Objective of the module:** The aim of this module to get knowledge, skills and understanding to apply electric circuit concepts

Learning Unit	Suggested Teaching/ Learning Activities	Delivery Context	Media
LU5: Install DC Circuits wiring	<p>Deliver an illustrated presentation which consist of following points :</p> <ul style="list-style-type: none"><li>• Select wiring tools, components, accessories and cables as per requirement</li><li>• Introduction to tools and accessories for DC Wiring.</li><li>• Connecting different components of DC circuits according to terminal tags and labels as per standard diagrams.</li><li>• Compare the observed results with the desired results of implemented DC circuits.</li><li>• Study of DC Relays and Switches.</li><li>• Understand Latching and Unlatching circuit with DC wiring.</li><li>• Knowledge of different types of Logic Gates</li></ul> <p><b>Learners</b> must be introduced various electrical and control wires and cables and their size selection according to load must be practiced.</p> <p><b>Learners</b> must be introduced with DC Relays and switches and their connection in simple circuits.</p>	Electrical Lab	<ul style="list-style-type: none"><li>• White Board</li><li>• Multimedia /Internet</li><li>• Videos for understanding of Electrical and Control cables.</li></ul> <p><a href="https://www.youtube.com/watch?v=SXZXtD60t2g">https://www.youtube.com/watch?v=SXZXtD60t2g</a></p> <p><a href="https://www.youtube.com/watch?v=M5mg6G8ff1M">https://www.youtube.com/watch?v=M5mg6G8ff1M</a></p> <p><a href="https://www.youtube.com/watch?v=haOxJohC9cM">https://www.youtube.com/watch?v=haOxJohC9cM</a></p> <p><a href="https://www.youtube.com/watch?v=AT_GjUjNFpo">https://www.youtube.com/watch?v=AT_GjUjNFpo</a></p>

**Module 5: 071400935 Apply Electric Circuit Concepts****Objective of the module:** The aim of this module to get knowledge, skills and understanding to apply electric circuit concepts

Learning Unit	Suggested Teaching/ Learning Activities	Delivery Context	Media
<ul style="list-style-type: none"><li>• <b>LU6:</b> Install AC circuit wiring</li></ul>	<p>Deliver an illustrated presentation which consist of following points :</p> <ul style="list-style-type: none"><li>• Select wiring tools, components, accessories and cables as per requirement</li><li>• Introduction to tools and accessories for AC wiring.</li><li>• Types of cables.</li><li>• Connecting different components of AC circuits according to terminal tags and labels as per standard diagrams.</li><li>• Compare the observed results with the desired results of implemented AC circuits.</li><li>• Study of AC relays contactors and switches.</li><li>• Differentiate the single phase and three phase electrical wiring.</li><li>• Understand reverse-forward, star-delta and DOL (Direct Online) operations for motors using relay logic.</li></ul> <p><b>Learners</b> must be introduced various electrical and control wires and cables and their size selection according to load must be practiced.</p> <p><b>Learners</b> must be introduced with AC Relays and switches and their connection in simple circuits.</p>	Electrical Lab	<ul style="list-style-type: none"><li>• White Board</li><li>• Multimedia /Internet</li></ul>



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Module-6

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**Module 6: 071400936 Install Automation Instruments****Objective of the module:** The aim of this module to get knowledge, skills and understanding to install automation instruments.

Learning Unit	Suggested Teaching/ Learning Activities	Delivery Context	Media
<b>LU1:</b> Install Digital Instruments	<p>Begin the session with the illustration of the basic terminologies and sensors related to digital electronics with respect to the industrial automation. Include the examples of following terms;</p> <ul style="list-style-type: none"><li>• Normally Open</li><li>• Normally Close</li><li>• NPN Switching</li><li>• PNP Switching</li><li>• Transmitter &amp; Receiver</li><li>• Photo Sensor</li><li>• Capacitive Sensor</li><li>• Inductive Sensor</li><li>• Solenoid</li><li>• Micro Switches</li><li>• Pressure Switches</li></ul> <p>Deliver the comprehensive presentation on the digital instruments and installation of digital instrument. Ensure that presentation address the following points;</p> <ul style="list-style-type: none"><li>• Digital multimeter</li><li>• Use of electrical tool kit</li><li>• Operational knowledge of sensors</li><li>• Two wires and three wires sensors</li></ul>	Lab / Workshop	<ul style="list-style-type: none"><li>• White Board</li><li>• Multimedia /Internet Illustration of tools and equipment support materials used for digital instrument installation</li><li>• Video Lectures and animations</li></ul> <p><a href="https://www.youtube.com/watch?v=U2XepZNbWi8">https://www.youtube.com/watch?v=U2XepZNbWi8</a></p> <p><a href="https://www.youtube.com/watch?v=4mQ3o1t4Ssg">https://www.youtube.com/watch?v=4mQ3o1t4Ssg</a></p> <p><a href="https://www.youtube.com/watch?v=lalkUPQ9Gfs">https://www.youtube.com/watch?v=lalkUPQ9Gfs</a></p>

## Module 6: 071400936 Install Automation Instruments

**Objective of the module:** The aim of this module to get knowledge, skills and understanding to install automation instruments.

Learning Unit	Suggested Teaching/ Learning Activities	Delivery Context	Media
	<ul style="list-style-type: none"> <li>• Understanding the data sheets of the digital instruments</li> <li>• Troubleshooting the sensors connections and check for any faults</li> </ul> <p>Following the presentation arrange an answer question session of the trainees to evaluate the understating of the trainees.</p> <p>During the practical session provide the electrical tool kit, digital instrument and technical datasheet to each pair. Each pair should identify the terminals of the sensors and install them according to data sheet using electrical tool kit. Each pair should test the connection of the digital instruments.</p>		
<b>LU2:</b> Install Analogue Instruments	<p>Begin the presentation with the brief comparison of the analogue and digital instruments with respect to industrial automation. Lead the presentation to the basic terminologies of the analogue instrument and deliver a detailed presentation on the analogue instruments. Ensure that presentation addresses the following points;</p> <ul style="list-style-type: none"> <li>• Analog to Digital Conversion</li> <li>• Digital to Analog Conversion</li> <li>• Amplification</li> <li>• Signal Conditioning</li> <li>• Strain Gauge</li> </ul>	Lab / Workshop	<ul style="list-style-type: none"> <li>• White Board</li> <li>• Multimedia /Internet</li> <li>• Illustration of tools and equipment support materials used for analogue instrument installation</li> <li>• Video Lectures and animations</li> </ul> <p><a href="https://www.youtube.com/watch?v=gZjBx9cdro">https://www.youtube.com/watch?v=gZjBx9cdro</a></p> <p><a href="https://www.youtube.com/watch?v=gZjBx9cdro">https://www.youtube.com/watch?v=gZjBx9cdro</a></p>

**Module 6: 071400936 Install Automation Instruments****Objective of the module:** The aim of this module to get knowledge, skills and understanding to install automation instruments.

Learning Unit	Suggested Teaching/ Learning Activities	Delivery Context	Media
	<ul style="list-style-type: none"><li>• Analog signal types and levels</li><li>• Knowledge of different analogue instruments like temperature sensor, pressure sensor, flow sensor, level sensor and load cell</li><li>• Two wire, three wire and four wire sensors interface</li><li>• Understanding of technical data sheets of the analogue instruments</li><li>• Connecting the sensors for final operation and check for any faults</li></ul> <p>Following the presentation arrange a group discussion for the comprehensive understating of the analogue instruments, comparison of analogue and digital instruments.</p> <p>During the practical session provide the electrical tool kit, analogue instrument and technical datasheet to each pair. Each pair should identify the terminals of the sensors and install them according to data sheet using electrical tool kit. Each pair should test the connection of the analogue instruments for final operation.</p>		<a href="https://www.youtube.com/watch?v=h0CGtr4SC9s">h?v=h0CGtr4SC9s</a> <a href="https://www.youtube.com/watch?v=o0LLV5GP6Ow">https://www.youtube.com/watch?v=o0LLV5GP6Ow</a>
<b>LU3:</b> Install Hydraulic and Pneumatic Equipment	Deliver a presentation on the hydraulic and pneumatic equipment. Ensure that following points are addressed in the presentation; <ul style="list-style-type: none"><li>• Various tools used to install hydraulic and pneumatic instruments</li></ul>	Lab / Workshop	<ul style="list-style-type: none"><li>• White Board</li><li>• Multimedia /Internet</li><li>• Technical manuals of Hydraulic and Pneumatic equipment</li></ul>

**Module 6: 071400936 Install Automation Instruments****Objective of the module:** The aim of this module to get knowledge, skills and understanding to install automation instruments.

Learning Unit	Suggested Teaching/ Learning Activities	Delivery Context	Media
	<ul style="list-style-type: none"><li>• Study of Hydraulic and pneumatic system drawings for comprehensive understanding of symbols</li><li>• Operation knowledge of various hydraulic and pneumatic valves and actuators like direct control valve (shuttle valve, check valve, 2/2-way valve, 3/2-way valve, 5/2-way valve. 5/3-way valve)</li><li>• Pressure control valve like pressure limiting, pressure regulator, pressure sequencing valve</li><li>• Limits switches, pressure gauges, rotary actuators</li><li>• Types of cylinder (single acting; double acting)</li><li>• Different valve actuation methods like level operated, pilot operated, solenoid operated etc.</li><li>• Operation of cascade control</li><li>• Troubleshooting techniques during pneumatic and hydraulic operations</li><li>• Safety practices during hydraulic and pneumatic operations</li></ul> <p>Following the ask questions to the trainees to evaluate the understating of the trainees.</p> <p>During the practical session provide the basic tool kit to the pair of the trainee to test the different</p>		Video Lectures and animations  <a href="https://www.youtube.com/watch?v=rS73PvrX6zw">https://www.youtube.com/watch?v=rS73PvrX6zw</a>  <a href="https://www.youtube.com/watch?v=fzRaoq-b1Lw">https://www.youtube.com/watch?v=fzRaoq-b1Lw</a>

**Module 6: 071400936 Install Automation Instruments****Objective of the module:** The aim of this module to get knowledge, skills and understanding to install automation instruments.

<b>Learning Unit</b>	<b>Suggested Teaching/ Learning Activities</b>	<b>Delivery Context</b>	<b>Media</b>
	direct control valve, pressure control valve, limit switches etc. Each pair should discuss the operation of the hydraulic and pneumatic instrument. Each pair should install the hydraulic and pneumatic equipment using the basic installation tools and drawings. Each pair should ensure the safety precautions while performing the installation of the hydraulic and pneumatic equipment. Each pair should test the equipment for final operation.		

